Han Kim

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EDUCATION

The Johns Hopkins University **Baltimore, MD**
Master of Science and Engineering in Biomedical Engineering: Computational Medicine graduated August 2020
The Johns Hopkins University **Baltimore, MD**
Bachelor of Science in Biomedical Engineering

RELEVANT COURSEWORK & SKILLS

Coursework: Precision Care Medicine, Computational Biology and Bioinformatics, Methods in Biostatistics, Machine Learning, Computational Medicine, Data Science for Biomedical Engineering, Signals and System, Systems Bioengineering
Software/Coding: R (main), Python, Matlab, Java, SQL, Bash**,** Git, Linux

WORK EXPERIENCE

Data Scientist **Baltimore, MD**
The Johns Hopkins Precision Medicine Center of Excellence for Neurocritical Care *August 2020 – Present*

- Leading the technical planning and implementation of data acquisition, feature engineering, and statistical modeling (ML) of JHU patient cohorts admitted to the Neuro Critical Care Unit.
- Developing and implementing feature engineering pipeline for 160hz physiologic bed-side monitoring waveform data and conducting research into the efficacy of added information from waveform signatures as compared to lower frequency signals.
- Prototyping ML models to efficiently triage post neurosurgery patients and determine whether the patient requires cares within the neuro intensive care unit.
- Pursuing further external validation of cardiac arrest and traumatic brain injury prognostication utilizing curated Johns Hopkins patient cohort.
- Conducting treatment response modeling for use as preliminary results for R21 and RO1 NIH grants based on my TBI Thesis results. R21 submitted OCT 2020, RO1 ready for submission for FEB 2021.

Research Laboratory Manager **Baltimore, MD**
Laboratory of Computational Intensive Care Medicine, JHU *August 2020 – Present*

- Mentoring and training 8 undergraduates and graduate students undertaking precision medicine projects utilizing retrospective publicly available datasets (eICU and MIMIC) and Johns Hopkins PMAP curated PHI datasets.
- Co-PI for 10 on-ongoing projects. Research topics and interests can be found on laboratory webpage LCICM.jhmi.edu

Department of Biomedical Engineering & Applied Biomedical Engineering, JHU **Baltimore, MD**
Teaching Assistant *Summer '18, Summer '19, Fall '19, Spring '19*

- Mentored and provided expertise to 8 Precision Care Medicine course teams during their year-long data-driven precision healthcare projects by providing proper data science practices, data pre-processing, machine learning modeling tasks, statistical analysis, and programming (R, Python).
- Provided my previous experience in leading a successful project to help each team successfully communicate and collaborate between their clinical/biomedical PIs and engineering PIs.
- Prepared cell cultures for Microcontact Printing lab and pulse oximetry waveform signal processing Matlab scripts for Biophotonics lab; and assisted 30+ students throughout labs.

PROJECT EXPERIENCE

Discovery and Validation of Traumatic Brain Injury (TBI) Subphenotypes in the ICU Stratum **Baltimore, MD**
Thesis Project; Johns Hopkins Medical Institute, Dr. Robert Stevens *August 2019 – August 2020*

- Utilized unsupervised learning, specifically k-mean, hierarchical, db-scan, spectral, and consensus clustering on predictive risk factors of 2,000 TBI patients to discover the most optimal clustering method to identify sub-categories ("endotypes") of TBI.
- Identified four clinically meaning endotypes/clusters using only quantitative physiologic patient characteristics that are statistically different in terms of certain physiological characteristics, treatment response, and outcome trajectories that have significant implications for selection of patients for treatment development and clinical trials.
- Externally validated endotypes using a separate retrospective electronic health record database to support significance and reliability of the results.
- Awarded JHU ACCM StAAR Grant (60k) in June 2020 to further validate promising results utilizing data-driven approach.
- Thesis titled: *Development and Validation of Traumatic Brain Injury Outcome Prognosis Model and Identification of Novel Quantitative Data-Driven Endotypes*.

Development and Validation of early TBI Prognostication of Clinical Outcomes **Baltimore, MD**
Thesis Project; Johns Hopkins Medical Institute, Dr. Robert Stevens *August 2019 – August 2020*

- Developed highly discriminative TBI clinical outcome prognostication model utilizing features engineered from day 1 of ICU admission achieving AUROC of > 0.9 for both test (eICU) and external validation (MIMIC III).
- Outperformed baseline gold standard IMPACT and CRASH models by AUROC > 15%.
- Retained model interpretability through usage of carefully engineered and curated features and simpler models such as generalized linear models, random forest, and XGBoost.

Computational Model to Predict Adverse Drug Reactions Prior in ICU patients **Baltimore, MD**
Lead Researcher; Johns Hopkins Medical Institute, Dr. Nadar Faraday *August 2019 – December 2020*

- Identified patients experiencing adverse drug reactions after receiving the beta blocker drug Carvedilol.
- Created classification models based on selected 40 clinical and heart rate time series derived features to predict with high performance (AUC 0.85) whether a patient will suffer from an adverse drug reaction prior to the next Carvedilol administration.
- Implementing a clinical decision support tool into the Johns Hopkins Precision Medicine Analytics Platform (PMAP) to allow for prospective validation on JHU patients.
- Awarded JHU ACCM StAAR Grant (60k) in June 2020 to further validate promising results utilizing data-driven approach.

A Computational Model for Prediction of Cardiac Arrest Outcome using eICU Database **Baltimore, MD**
Project Lead; Johns Hopkins Medical Institute, Dr. Winslow, Dr. Stevens *August 2018 – July 2019*

- Preprocessed and explored 200,000 patient electronic health record and physiological time-series data utilizing various data mining algorithms to extract predictive features potentially predictive of cardiac arrest (CA) outcomes.
- Predicted Neurological Outcome with the best AUC of 0.87 achieved by gradient boosting (XGboost) as well as our stacked ensemble model. This was 14% higher performance compared to the baseline APACHE model.
- Proposed and applied transfer learning to pre-train recurrent neural network weights for time series prediction using non-cardiac arrest patient time series data with mortality outcomes. Improved time series predictions by 3 to 4% AUC.
- Presented the results at BMES 2019, RESS 2019, NICIS 2019, EURONEURO 2020 conferences.

Pancreatic Cancer CT Image Processing and Patient Prognosis Prediction, JHMI **Baltimore, MD**
Research Assistant; Johns Hopkins Medical Institute, Dr. Elliot Fishman *July 2018 – January 2019*

- Utilized computer vision and feature engineering to extract radiomics features from segmented pancreatic cancer CT.
- Performed 3D reconstructions of segmented tumor and non-tumor region to extract first order statistics, size, volume, wavelet transformations, and other predictive statistical radiomic features.
- Predicted the binary classification of whether the radiomic features indicated the presence of a tumor. Random forest was the best performing model using high dimensional image derived statistical features. A convolutional neural net was also trained for comparison and found to have comparable performance.

PUBLICATIONS

- **Thesis: Kim HB.** Development and Validation of Traumatic Brain Injury Outcome Prognosis Model and Identification of Novel Quantitative Data-Driven Endotypes. Jhu.edu. Published online August 2020. doi:http:// jhir.library.jhu.edu /handle/ 1774.2/ 63275
- **Kim HB**, Masteller A, Sankar S, Ding K, Liu X, All AH. Recent Developments in Prosthesis Sensors, Texture Recognition, and Sensory Stimulation for Upper Limb Prostheses. Ann Biomed Eng. 2021 Jan;49(1):57-74. doi: 10.1007/s10439-020-02678-8. Epub 2020 Nov 2. PMID: 33140242.
- **Kim, Han B**. et al. "A Physiology-Driven Computational Model for Post-Cardiac Arrest Outcome Prediction." ArXiv abs/2002.03309 (2020): n. pag. (in revision)
- Wong AI, **Kim H,** Charpignon M, , Monares-Zepeda E, Madushani R WMA., Adhikari L, Kindle RD, Kutner M, Lough M, Celi LA, Analysis of the ventilator associatedcondition (VAC) in large open ICU datasets. (under review)
- Postcardiac Arrest Physiological Endotype Discovery with Unsupervised Machine Learning (in progress)
- Computational Subphenotype Discovery and Validation of ICU Stratum Traumatic Brain Injury Patients (in progress)
- Predicting Adverse Drug Reactions to Carvedilol Using Physiological Time Series Data Obtained in Intensive Care Units (in progress)